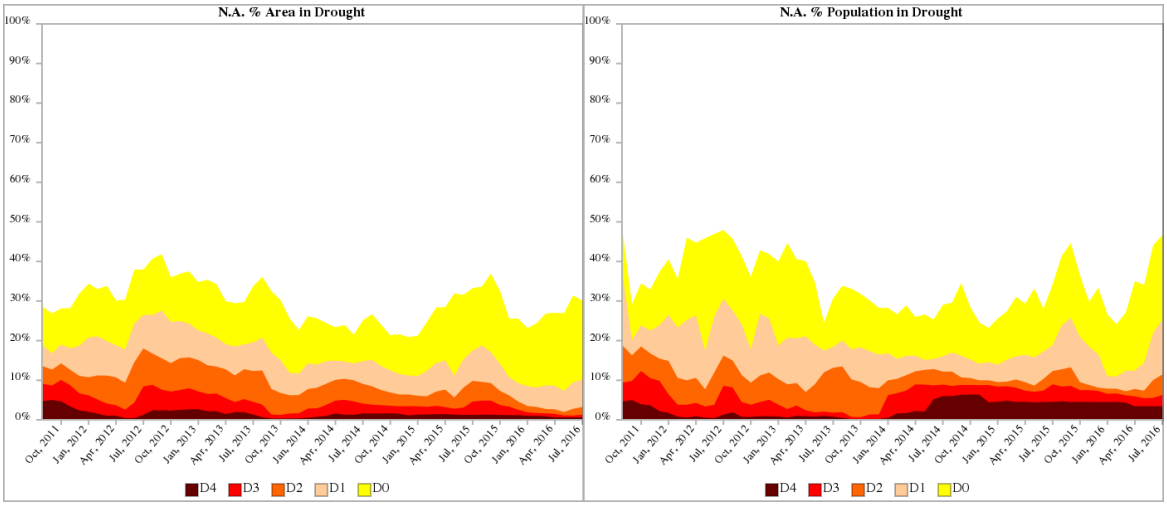
North American Drought Monitor – July 2016

At the end of July 2016, moderate to exceptional drought (D1-D4) affected approximately 10.0% of the area and 25.2% of the population of North America. These percentages are an increase of 0.7% for area and 3.3% for population compared to the values for the end of June 2016.



CANADA: Overall conditions across Canada for the month of July could be characterized as stormy, with some areas of persistent drought remaining. Across the West, southern portions received substantial rainfall (upwards of 150-200 mm in some places), leading to vast improvement overall. Southern Ontario, however, continued to experience dry conditions, with further drought developing in the Niagara region and persisting throughout much of the rest of the region. The remainder of the country saw minimal changes.

D0 (Abnormally Dry) conditions in the northwestern corner of British Columbia remained in place given the moderate to high risk suggested by NRCAN's Fire Weather Drought Code. However, precipitation values compared to normal indicated some relief for the region; as such, the D1 (Moderate Drought) patch was removed and D0 was reduced. A pocket of D1 was designated for the northern edge of B.C., into the southeastern corner of Yukon, given the up to 75 mm below normal precipitation received in the past three months. A small area of D1 conditions on the mid-eastern portion of Haida Gwaii also remained for the month of July.

Conditions generally improved throughout southern B.C. with a small pocket of dryness over parts of Vancouver Island being the exception to this. As well, longer-term dryness still remained in the area according to precipitation data from April 1st to current. Given these conditions, pockets of drought persisted, but D0 and D1 conditions on Vancouver Island were pulled back to the southern half. D0 in the interior region of the mainland was also eliminated as precipitation was shown to be in the 60th to 80th percentile. D1 conditions remained in the lower mainland between Surrey and Hope.

Conditions across the Prairies improved overall for July. The area of D2 (Severe Drought) surrounding Calgary was alleviated by very high rainfall received for the month (upwards of 150 mm in some areas). A few D0 pockets were left scattered around Calgary, with two small D1 patches around Kananaskis Village and Maycroft due to very low precipitation received in the past six months compared to normal. A D1 pocket emerged just west of Edmonton due to short term dryness, with a lack of precipitation only seen once in up to 25 years in the past two months. With multiple heavy storms hitting southern Saskatchewan throughout July, dumping between 115 – 150% of average precipitation in the previously dry areas, all drought conditions were alleviated. In the north, however, the band of D0 conditions spanning from NWT, through Uranium City towards just north of Fort McMurray still remained, though slightly reduced. The trend of improvement carried into northern Manitoba, where dry conditions were pulled back eastward. A patch was left northeast of Lake Winnipeg, however, due to a lack of precipitation locally. The D1 surrounding Port Nelson was also reduced but still remained due to the region receiving 50 mm less than average precipitation over the past three months.

Much of southern Ontario continued to experience patches of significant drought in July; the majority of the agricultural region was impacted by Abnormally Dry (D0) conditions for yet another month. As of July 24th, nearly 55% of the agricultural area in Ontario was impacted by Very Low to Record Low precipitation since April 1, 2016, affecting more than 17,000 farms and close to 1.5 million cattle. While certain pockets received good precipitation over the past month helping to alleviate drought concerns, such as west of Ottawa and west of London, a large pocket surrounding Lake Ontario remained in Moderate Drought. One pocket of D2 remained northeast of Toronto, with another pocket developing around the Niagara region, given recent depreciating conditions. Drought conditions in northern Ontario only shifted slightly, with some areas experiencing drier conditions while others improved. According to satellite-derived data indicating adequate precipitation, the large area of D0 across much of northeastern Ontario was removed. Some pockets of D0, however, were added around Williams Lake and Hornepayne because of recent dry conditions developing. As similar to June, much of the dry conditions in southern Ontario carried over into southern Québec; the area of D0 encompassing much of southern Québec, along with a small pocket of D1 west of Montréal, persisted into July as a result. A pocket of D1 around Sherbrooke also emerged following yet another dry month, along with the persistent lack of precipitation in the past six months.

Across the Atlantic region, D0 conditions from June continued into July. P.E.I and parts of northern Nova Scotia experienced particularly dry conditions and as a result, a patch of D1 emerged in the area. Another consequence of the dry conditions resulted in the slight expansion of the previously depicted D0 across the region.

Changes to the drought conditions across areas of northern Canada were fairly minimal for the month. Conditions surrounding Yellowknife stayed fairly consistent to the previous assessment. However, a pocket of dry conditions was identified just north of this area, resulting in the creation of a D0 pocket. As well, satellite-derived data indicated that the border region between the Yukon Territory and Northwest Territories continued to depreciate, leading to the creation of a pocket of Moderate Drought (D1).

UNITED STATES: Extreme heat arrived during July, but rarely strayed from the Deep South. However, southern sections of the Rockies and High Plains suffered through a month-long heat wave, leading to topsoil moisture depletion as well as an increase in stress on rangeland, pastures, and rain-fed summer crops. Meanwhile, hot weather and spotty showers led to drought persistence across the interior Southeast, mainly from northern and central Mississippi to the southern Appalachians.

Farther north, Midwestern growing conditions remained mostly favorable, despite a brief, mid-month surge of heat and humidity that increased discomfort levels for humans and livestock. On July 31, more than three-quarters (76 percent) of the U.S. corn and 72 percent of the soybeans were rated in good to excellent condition. Showery July weather prevailed across the heart of the Midwest, although drought remained a problem in parts of South Dakota, Michigan, and Ohio. Drought in the lower Great Lakes region extended eastward to the northern Atlantic Coast, resulting in significant agricultural consequences in parts of the Northeast.

In contrast, abundant showers dotted the northern and central Plains, while an erratic Southwestern monsoon grew stronger as the month progressed. Late-month Southwestern showers provided beneficial moisture but had little effect on long-term precipitation deficits. Notably, monsoon-related showers largely did not reach the northern Intermountain West—a region that experienced a sharp increase in wildfire activity as the month progressed. Elsewhere, typical summer dryness prevailed in California, which also endured a few large wildfires, while occasional showers accompanied near-normal Northwestern temperatures.

During the 4-week period ending on August 2, 2016, contiguous U.S. drought coverage increased to 21.12%—up 3.35 percentage points. Drought coverage has nearly doubled since reaching a 5½-year minimum of 12.41% on March 15, 2016. During the summer of 2016, drought coverage and intensity has increased in several areas across the Plains, South, and Northeast, but has mostly shrunk in the Midwest—except in the lower Great Lakes region.

In recent weeks, extreme drought (D3) has returned to a few areas east of the Rockies, including parts of the Black Hills and the southern Appalachians. On August 2, extreme drought covered just over 5% of South Dakota and nearly 4% of Wyoming. In the Southeast, coverage of D3 approached 13% in Georgia, was nearly 3% in Alabama, was just under 2% in South Carolina and Tennessee; and topped 1% in Mississippi. Severe drought (D2) covered parts of the Northeast, with D2 coverage by August 2 reaching 62% in Massachusetts, 24% in New York, 22% in New Hampshire, 21% in Rhode Island, and 10% in Connecticut. Meanwhile, 84% of California was in drought (D1 or worse) on August 2, while 43% was considered to be in extreme to exceptional drought (D3 to D4).

Outside of the mainland U.S., coverage of abnormal dryness (D0) in Alaska decreased slightly from 22 to 21% during the 4-week period ending August 2. The decrease was due to heavy precipitation in west-central Alaska. Meanwhile, rain associated with Tropical Storm Darby contributed to an ongoing decrease in Hawaiian drought coverage. Only 14%

of Hawaii was considered to be in drought by August 2, down from 21% on July 5 and 57% at the end of May. Elsewhere, Puerto Rico's drought situation was nearly unchanged during July, with moderate drought (D1) coverage ranging from 5 to 6%.

Historical Perspective: According to preliminary information provided by the National Centers for Environmental Information, the contiguous U.S. experienced its 14th-warmest, 52nd-wettest July during the 1895-2016 period of record. With an average temperature of 75.3°F (24.0°C), 1.6°F (0.9°C) above the 20th century mean, it was overall the nation's hottest July since 2012. However, statistically significant July heat was confined to the southern and eastern U.S. For example, it was the hottest July on record in New Mexico, tying 2003, and Florida, edging 1998. The July average temperature was among the ten highest values on record in Arizona, Texas, Louisiana, Tennessee, and ten Atlantic Coast States from Georgia to Massachusetts. In contrast, it was the 44th-coolest July in Oregon; similar rankings (among the fifty coolest) were noted in Idaho, Iowa, and Washington.

Precipitation averaged 2.87 inches (72.9 mm)—103% of normal—across the Lower 48 states, marking the 52nd-wettest July during the 122-year period of record. However, patches of wet and dry conditions tended to offset each other. As a result, top-ten rankings for July wetness occurred in Illinois, Kentucky, Minnesota, Missouri, and North Dakota, while top-ten values for July dryness were noted in Florida, Georgia, New Mexico, and Wyoming. In Illinois, it was the third-wettest July, with an average of 6.85 inches (174.0 mm)—behind only 8.10 inches (205.7 mm) in 1958 and 7.61 inches (193.3 mm) in 1992. Conversely, it was the second-driest July in Georgia and the third-driest July in Florida. With an average of 2.66 inches (67.6 mm)—just 48% of normal—Georgia narrowly missed its July 1980 record low of 2.54 inches (64.5 mm).

Agricultural and Hydrological Highlights: During July, the portion of both the U.S. corn and soybean production areas in drought remained nearly unchanged at 5 to 7%. Among the major production states, Ohio led with 53% of its corn production area and 50% of its soybean area in drought on August 2. Looking at the Midwestern States, only Ohio (13%), Michigan (12%), and South Dakota (11%) reported at least one-tenth of their corn in very poor to poor condition on July 31, according to the U.S. Department of Agriculture. Similarly, Midwestern soybeans were rated at least one-tenth very poor to poor only in Michigan (12%) and Ohio (11%). Still, Midwestern crops were mostly faring well, with 76% of the U.S. corn and 72% of the soybeans rated in good to excellent condition on July 31.

In addition to corn and soybeans, row crops that were rated at least two-thirds good to excellent on July 31 included barley (72%) and spring wheat (68%). Peanuts, rice, and sorghum were rated 66% good to excellent. In fact, only cotton (50% good to excellent; 15% very poor to poor) showed significant drought stress. Texas, the leading U.S. cotton production state, reported that 20% of its cotton was rated very poor to poor on July 31, up from 10% just 4 weeks earlier.

On August 2, drought was affecting 18% of the U.S. cattle inventory, up from 15% on July 5. Similarly, 17% of the nation's hay area was in drought, up from 14% in early July. Nevertheless, 51% of the U.S. rangeland and pastures were rated good to excellent on July

31, while only 17% were rated very poor to poor. States reporting at least one-quarter of their rangeland and pastures in very poor to poor condition on July 31 included California (40%), Oregon (40%), Pennsylvania (40%), Georgia (37%), South Carolina (37%), Arizona (36%), Ohio (29%), Montana (29%), Michigan (28%), Alabama (26%), New Mexico (26%), Nevada (25%), and all six New England States—led by Connecticut (78%), Rhode Island (69%), and New Hampshire (60%).

On August 1, 2016, reservoir storage as a percent of average for the date was significantly below average in several Western States. Specifically, statewide storage ranged from 55 to 70% of average for this time of year in Arizona, Nevada, and New Mexico. Meanwhile in northern California, partial recovery from long-term drought was evident in reservoir storage. However, California's statewide recovery was uneven, with a trend toward lower storage (and drought persistence through a fifth consecutive year) in southern watersheds. Elsewhere, statewide reservoir storage continued to decline (and was slightly below average) in the Northwest, mainly due to a premature end to the snow-melt season and insufficient spring and summer rainfall to sustain robust streamflow into reservoirs during the peak water-usage season.

MÉXICO: In July 2016 above-normal rains fell in the northwest and west, mainly due to the North America monsoon, as well as in central and southeast Mexico, due to trough lines and tropical waves. On the other hand, rain deficits were observed in the north, north-east and southern coastal areas. The scarcity of rain in the north and north-east was associated with an upper-level high that brought stable conditions, while low rainfall in the southern coastal region was attributed to the position of the Intertropical Convergence Zone (ITZC) below 10° N latitude, further south than usual for this time of the year, and by few rains provided by far west Tropical Storm Estelle (15-22 July) and Hurricane Frank (21-28 July), both in the Pacific.

The much-needed rains in the northwest and west helped Sinaloa to reach its tenth wettest July, where July's precipitation was 24% above normal for the month; meanwhile Aguascalientes and Baja California experienced their eighth and second wettest July in the 1941-2016 records, respectively. In contrast, in the south and southeast, Oaxaca and Yucatan experienced their ninth driest July, while Chiapas had its tenth driest July.

About 16.59% of the country was in moderate to extreme drought (D1-D3) as of July 31, an increase of 1.44% with respect to June 30 figures. The main drought core areas were in the northwest, central-north, east and southeast of the country. For the year, the abnormally dry conditions (D0) have tripled in growth from 13.2% in January to 40.0% at the end of July.

Drought changes that were observed over the last month due to favorable rainfall, included the reduction of moderate to severe drought (D1-D2) in the Northwest, where Baja California changed from 46.1% to 39.2% and Sonora from 52.6% to 33.6%. However, extreme drought (D3) still persisted in northern Baja California, covering 5.1 percent since May 15. In the northern parts of the country, a reduction from 5.7% to 2.5% was seen in Chihuahua, thanks to rainfall over the last fifteen days, but this did not happen in Coahuila, where higher-than-normal temperatures throughout the month resulted in new development

of moderate drought (D1) that covers 4% of this state across the Texas border. In the central-north areas, Durango and San Luis Potosi increased their areas with moderate drought by 2.5% and 28.5% respectively. In the south of the country, long-term moderate and severe drought continued and extreme drought (D3) intensified to cover 1.5% of Oaxaca and 7% of Veracruz. Early August rains in this area may improve conditions on the August map. Finally, severe drought covered 8.3% of Campeche, 3% of Quintana Roo, and 29.7% of Yucatan.

With the exception of isolated areas in Chihuahua, in the central region, southern Veracruz and Tabasco, July was warmer than normal in most of the country. Mean temperature anomalies of up to 5 degrees Celsius above normal were observed in Chihuahua, Durango and the Baja California Peninsula. The northeast was also warm with anomalies between 3 and 5 degrees Celsius above normal. The mean temperature at the national level of 26.8 °C was 3.2 °C warmer than normal and was classified as the warmest July recorded in the 1971-2016 period. Baja California, Coahuila, Chihuahua, Durango and Nuevo Leon (in the north of the country) had also their warmest July on record, together with Colima, Hidalgo, Queretaro and Tlaxcala (in the central regions), alongside Chiapas. The greatest number of days with maximum temperature above 40°C was observed in Sonora, northern Chihuahua, Coahuila and northern Nuevo Leon and Tamaulipas. This unusual heat fostered the development of dryness or drought in Coahuila and Nuevo Leon.

The Information Service for Agri-Food and Fishing (SIAP) reported growth in agricultural yield despite 8.4% less area sown than the spring-summer season of last year. About 2,400 hectares of crops such as corn and chili in Tamaulipas, San Luis Potosí and Durango, were affected mainly by hailstorms, drought or diseases. Regarding livestock, poultry farming continued to emphasize its growth, reporting a 4.4% increase in poultry meat and 3.0% in egg, compared to the same period of the previous year; pork production also reported an increase of 3.2% at the end of July 2016.

The lack of rain contributed to an increase in forest fires over the country, with around 245,812 hectares burned in the period from January 1 to August 4 2016, placing this period as the eighth area most burned since 1998, according to the National Forestry Commission (CONAFOR) weekly fires report. The states with the largest area burned were Jalisco, Sonora Oaxaca, Michoacan, Chihuahua, Guerrero, Durango, Puebla, Chiapas and Zacatecas. This represented 77.6% of the total area burned at the national level.